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LAWN AERATOR

This invention relates to a powered lawn aerator.

5 Background of the invention

It has long been known that grass lawns and turfed areas benefit from their roots having direct access to fertilisers, air and oxygen to improve growing conditions and this has been addressed by machines which punch a series of holes into the lawn surface: a system known as aeration. Not only does aeration provide the direct access to the root zone but it helps ease compaction of the soil caused by pedestrian traffic, thereby creating a better growing environment and encouraging deeper root growth, which also helps the finer grasses to surface. Aeration is also used to change the composition of the soil over time by removing plugs of, say clay, and filling these holes with a loam mixture, a more conducive growing medium.

20 There are two main methods of aerating depending on the type of tine used to make the holes, normally 10-15mm in diameter. The first method uses solid, or static, tines and tends to be used on large areas of grassland e.g. golf fairways, to facilitate movement of air and water; however these solid spikes add to the problems of compaction. The second, and preferred, method is to use hollow tines which enter the material and whereby cores of soil are removed. This method generates minimal compaction of the soil around the walls of the hole.

30 Hollow tines come in two guises; either tractor mounted or pedestrian walk-behind machines. Many use a heavy rotary drum system with tines attached. As the drum passes over the lawn, the weight of the drum forces the hollow tines

into the ground. However this does create problems since the tine enters the ground at an angle. As the hollow tine enters the ground it tends to tear the grass and compact the soil at the point of entry. Similarly, as the tine leaves  
5 the ground at an angle at the opposite side of the hole, it tends to pull the surrounding soil up, thereby leaving a ridge. One remedy for this is to use a roller to get the lawn surface back to its flat surface.

An improvement to the rotary drum machine are machines  
10 where static tines penetrate the soil vertically, usually by the use of camshafts. However these machines need to be heavy in order for a sufficient force to be applied to the static tines to push the static tines down into the surface. The use of static hollow tines is common but relies on the  
15 subsequent penetration into the ground to force the soil core removed from the previous hole up the barrel of the tine and out through a chute. Where the soil is heavy and of a viscous nature, e.g. clay, this tends to clog the barrel meaning that the subsequent penetrations does not produce  
20 sufficient pressure to facilitate the removal of the soil contained in the tine from the previous penetration. The result of the previous core not being removed is that the full tine will perform more like a solid tine, thereby causing greater compaction.

25 An advance in the method of using solid tines is to use drill bits, similar to masonry drills, which are hydraulically driven into the ground. The rotating drill method requires less downward force to penetrate the soil than conventional solid tines. However these drills have a  
30 downward cutting force rather than a scooping action. The soil which is transported up the shank of the drill bit forms a volcanic ridge around each hole. The excavated soil is removed by a number of methods, for example sweeping or

blowing to the edge of the lawn for later collection and removal. By contrast, because the cores of soil generated by hollow tining are more dense, the method used to remove the cores may be different, for example by the use of 'sweeping' machines.

All of the aforementioned machine aerators are aimed at the professional market. However, there are some pedestrian models which can be used by domestic gardeners. Nevertheless, problems often arise due to limited access through gateways and poor manoeuvrability of the machines. The domestic gardener is then left with few poor choices, each of which requires considerable manual dexterity. The garden fork is still used by the most enthusiastic of gardeners as a form of solid spike aerating. Otherwise, there are versions of garden tools with solid and hollow tines, which are again forced into the ground by applying pressure through the foot. Finally, there is a rotary drum tool which has solid tines attached to a drum. The user then applies a force in a downward and forward direction, thereby forcing the tines to enter and exit the soil whilst the drum rotates.

When a hard stone e.g. flint is encountered within the soil, current aerators either continue with an equal amount of pressure upon each tine, resulting in damaged tines, or when a solid surface is struck, the machine stops.

### Statement of Invention

According to the present invention there is provided an aerator for aerating a medium such as soil, said aerator comprising; a plurality of drills, said drills being adapted to cut a hole in said medium; a plurality of hollow tine tubes arranged such that in use the tubes are in cooperating

relationship with a collection box; said tine tubes and said drills being arranged such that the cut medium is moved up the drills, through the hollow tine tubes and into the collection box.

5           Advantageously, the aerator has special drill bits with a double claw tip which cuts the soil vertically and 'scoops' the soil particles upwards. The double claw drill bits are designed to convey the maximum available amount of soil out of the hole being formed by the drill. Preferably, 10 the double claw drill transports the soil upwards via a helical staircase and up through the hollow tine tube.

          Preferably a thrower disc is mounted above the hollow tine and deflects the upward moving soil into a collection box.

15           Preferably, the drill shanks are held in place in a carousel. More preferably a double-tension push-tube is through the centre of each carousel. In this arrangement the push-tube is initially compressed and the whole drill and tine tube assembly contacts the surface of the lawn and 20 enters a short distance, resulting in the tine tubes being brought into a cooperating relationship with both the lawn and the soil-collection box. Secondly, the push-tube then continues in a downward motion. During the second stage the tine tubes stay in situ, i.e. in contact with the surface of 25 the lawn, and the drills enter the soil.

          In one arrangement each drill is held in place at its upper end by a constant tension spring which is set at a predetermined load equal to the required downward force required for drilling into the soil. When one or more of the 30 drill bit(s) encounters a solid surface, and therefore encounters an increased resistance, the continuing downward thrust creates enough force to exceed the predetermined load of the tension spring on the specific drill bit(s). The

spring mechanism thereby allows for compliance of the  
specific drill bit(s). This means that the specific drill  
bit(s) will not move further downward but that remaining  
drill bit(s), not encountering the solid surface, can  
5 continue downwards uninterrupted.

Each drill is driven by its own pulley, probably driven  
by a master reduction set according to the power unit  
properties. The aerator can easily provide for different  
powering options as it can have its own dedicated motor,  
10 electric or petrol. For the home gardener with lighter usage  
and seeking a cheaper motor-less option, he can use his own  
power drill (within its allowable performance), connecting  
to the master drive pulley via the chuck, with the power  
drill being held in place by a holster.

15 The use of elongated handles with the handle knobs some  
way distant from the push-rods means that the force required  
for exerting both downward and upward movement is  
substantially less than that being exerted at the push-rod  
heads. This reduction of force is in addition to the  
20 reduction of the force required to penetrate the soil by  
using a drill instead of a static tine.

Also according to the present invention there is  
provided a device intended for the cutting of holes in a  
medium of soils or similar, which produces said holes by a  
25 cutting action rather than punching, or compressing the  
medium, for the intention of aerating the medium. The device  
comprises sets of drills with hollow tine tubes to  
facilitate the movement of the cut medium up into a  
collection box, the whole assembly being pushed down into  
30 the soil by extended handles, with extended wheels at the  
rear to act as a counter-balance.

Advantageously the drill comprises of a cutting-bit for  
the device with claws to enable a scooping action, followed

by a body that is either twisted from the flat form, or otherwise fluted, to provide a helical staircase. The drill is rotated to produce the vertical shearing action for removal of the medium. The drill is introduced into the  
5 medium by a linear, or curvilinear, action, either by powered or manual means.

Preferably each drill bit has a thrower disc attached to deflect the upward moving soil particles.

Preferably hollow tine tubes connect the surface of the  
10 lawn to the aerator's soil collection box, and control both the drill position to its rotating axis during linear travel and the movement of the debris to any collection area.

Any singular drill and its drive mechanism would normally, but not necessarily, have the ability to comply  
15 with resistance to linear travel by movement or slippage within the driving mechanism against a force, which puts the drill in bias towards the cutting position. Such force may be produced by any suitable means.

Preferably the push tubes have a double tension  
20 mechanism to enable two forces to activate the drills and tine tubes for both downward and upward movement.

Advantageously the device further comprises a removable soil collection box through the bottom of which are a series of holes accommodating the tine tubes, wherein the box is  
25 mounted underneath the drilling assembly.

Advantageously a location device during the cutting operation may be either manual or an automatic system that measures the relative location of a footprint for a new set of holes.

30 An additional benefit of the design of the aerator of the present invention is that it is much lighter than other power aerators and is therefore more manoeuvrable.

**Brief Description of the Drawings**

Preferred embodiments of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 shows a view of the drill bit and with the drill bit held within a pulley;

FIGURE 2 shows a side view of four complete drill bits mounted within the carousel;

FIGURE 3 shows the drill cap and coiled spring;

FIGURE 4 shows the main assembly;

FIGURE 5 shows the base structure;

FIGURE 6 shows the drill assembly;

FIGURE 7 shows 2 views, A with drill & tine tube lowered, and B in its stationary position;

FIGURE 8 shows the soil collection box; and

FIGURE 9 shows a side view of the lawn aerator.

**Detailed Description of the Drawings**

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Figure 1 - shows a view of the drill bit 1 with a double claw and helical staircase design. Item 2 is the pulley. 3 is the thrower disc which deflects the soil particles down into the collection box via centrifugal force.

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Figure 2 - shows four drill bits mounted on the carousel 7. 4 is the push tube which connects to a handle. 6 is the drill cap with pin inside to hold and drive the drill bit and 5 is a constant force spring biasing the drill into the drive pulley.

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Figure 3 - shows the cap 6 with bearing which fits over drill bit, and 5 is the constant force spring set at a pre-

determined load ensuring adequate force for drilling, but compliance should the drill bit hit a stone.

Figure 4 - shows the main assembly, 4 being the push-tube connecting the carousel to the handle. 2 shows the pulleys which in this instance are driven by a timing belt. 8 is the static holding box. 9 where the drive pulley connects with the power source (not shown).

Figure 5 - shows the base structure with eight holes to take the eight drill bits, the particular size for this embodiment. 10 are the tubular members that guide the push tubes. 11 is the spider, our location device, whose arms each hold a hollow tine tube for debris guidance and axis control.

Figure 6 - shows the complete drill assembly with 12 being the tine tubes being held in place by the spider arms.

Figure 7 - shows a split sectional view of the main assembly. Side B, the right half of the diagram, shows the 'wavey-washer' type springs 13 that bias the first stage of the double downward action. 14 is a gas strut, the second stage, which biases the whole drilling system to home position. Side A, the left half, shows the drill bit 1 and tine tube 12 when placed down to the ground. This is achieved by when the push tube is pushed down, the drill assembly moves down against the 'wavey-washers' 13 a fixed distance in order for the tine tubes to make firm contact with the lawn. As the push tube continues downward, the gas strut 14 allows the drill bits to enter the soil while the tine tubes 12 remain on the surface.

Figure 8 - shows the soil collection box with the eight holes through which the drill bits and tube tines pass.

Figure 9 - shows a side view of the lawn aerator. 16 is a handle which lifts the whole drilling assembly enabling the soil collection box to be removed and emptied. 18 are



the rear wheels attached to an extended frame for when the handles are pulled down to commence drilling, the wheels act as a balancing resistance to ensure the assembly does not lift.